UNITED STATES PATENT AND TRADEMARK OFFICE

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EXAMINER
THAI, HANH B

ART UNIT	PAPER NUMBER
2163	

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Please find below and/or attached an Office communication concerning this application or proceeding.

	Application No.	**Applicant(s)**
Office Action Summary	10/008,565	CORBETT, PETER F.
	Examiner	**Art Unit**	
	Hanh B. Thai	2163	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>RCE filed 9/22/05</u>.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22,38,40,41,43,44,46 and 55-79* is/are pending in the application.

   4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22,38,40,41,43,44,46 and 55-79* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

   Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

   Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   a)☐ All   b)☐ Some * c)☐ None of:

   1.☐ Certified copies of the priority documents have been received.

   2.☐ Certified copies of the priority documents have been received in Application No. _____.

   3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

   * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
   Paper No(s)/Mail Date <u>6/30/05</u>.

4)☐ Interview Summary (PTO-413)
   Paper No(s)/Mail Date. _____ .

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: _____.

DETAILED ACTION

1.   The following is a Non-final Office Action in response to the Request for Continued

Examination filed September 22, 2005. Claims 23-37, 39, 42, 45 and 47-54 have been cancelled.

Claims 1-22, 38, 40-41, 43-44, 46 and 55-79 are pending in this application.

Response to Arguments

2.   Applicant's arguments regarding combining a plurality of unbalanced strip arrays to form

the balanced array of claim 1 has been considered but are moot in view of the new ground(s) of

rejection.

Claim Objections

3.   Claim 64 is objected to because of the following informalities: the equal "=" at line 14,

page 11 should be deleted. Appropriate correction is required.

Claim Rejections - 35 USC § 102

4.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the

basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on
> sale in this country, more than one year prior to the date of application for patent in the United States.

5.   Claims 1, 3, 8-12, 14-22, 55-58 and 61-79 are rejected under 35 U.S.C. 102(b) as being

anticipated by Stallmo et al. (US 6,052,759) previous cited.

Regarding claim 1, Stallmo discloses a method for enabling parity declustering in a

balanced parity array of a storage system, the method comprising the steps of:

-        combining a plurality of unbalanced stripe arrays, each unbalance stripe array

storing an unequal number of blocks per disk, to form the balanced array, the

balanced array storing substantially the same number of blocks on all disks, each

unbalanced stripe array having parity blocks on a set of storage devices that are

disjoint from a set of storage devices storing data blocks (summary; col.8, lines

45-51, Stallmo discloses organizing a plurality of disks of varying sizes of data

blocks "a plurality of unbalanced stripe arrays" into multiple rectangles of disks

that all contain the same number of blocks "balanced array"); and

-        distributing assignment of storage devices to parity groups throughout the

balanced array (col.7, line 66 to col.8, line 3).

Regarding claim 3, Stallmo discloses wherein the storage system is a filer (col.7, lines

36-42 and col.8, lines 5-9).

Regarding claim 8, Stallmo discloses the steps of configuring the balanced array as a

RAID-4 style array; initially under-populating the array with storage devices; and adding storage

devices until a fully populated array of predetermined size is achieved (abstract, Fig.1, Fig.4 and

col.9, line 47 to col. 10, line 7).

Regarding claim 9, Stallmo discloses that the storage devices are disks (summary and

col.9, lines 14-20).

Regarding claim 10, Stallmo discloses a system that enables parity declustering in a

balanced parity array of a storage system, the system comprising:

-        a plurality of storage devices, each storage device divided into blocks that are

further organized into stripes, wherein each stripe contains data and parity

blocks from each of the devices of the balanced array (summary; col.8, lines 45-

51 and col. 9, lines 14-20, Stallmo discloses storage disk is divided into

"squares" blocks);

-        a storage operating system including a storage layer configured to implement a

parity assignment technique that distributes assignment of devices to parity

groups throughout the balanced array (summary; col.7, line 66 to col.8, line 3

and lines 45-51); and

-        a processing element configured to execute the operating system to thereby

invoke storage access operations to and from the balanced array in accordance

with the concentrated parity technique (summary; col.7, line 66 to col.8, line 3

and lines 45-51).

Regarding claim 11, Stallmo discloses the storage layer further combines a plurality of

unbalanced stripe arrays to form the balanced array, each unbalanced stripe array having parity

blocks on a set of storage devices that are disjoint from a set of storage devices storing data

blocks (col.8, lines 45-51 and col. 9, lines 14-20).

Regarding claim 12, Stallmo further discloses the storage devices are disks and wherein

the storage layer is a RAID layer (abstract and summary).

Regarding claim 14, Stallmo discloses the storage system is a network-attached storage

appliance (Figs.1-4 and corresponding text, Stallmo).

Regarding claim 15, Stallmo discloses that the storage devices are one of video tape,

optical, DVD, magnetic tape and bubble memory devices ("306", Fig.3).

Regarding claim 16, Stallmo further discloses that the storage devices are media adapted

to store in formation contained within the data and parity blocks (col.8, lines 45-51 and col. 9,

lines 14-20).

Regarding claims 17 and 20, Stallmo discloses an apparatus for enabling parity

declustering in a balanced parity array of a storage system, the apparatus comprising:

- means for combining a plurality of unbalanced stripe arrays to form the balanced

    array, each unbalanced stripe array having parity blocks on a set of storage

    devices that are disjoint from a set of storage devices storing data blocks

    (summary; col.8, lines 45-51, Stallmo discloses organizing a plurality of disks of

    varying sizes of data blocks "a plurality of unbalanced stripe arrays" into

    multiple rectangles of disks that all contain the same number of blocks

    "balanced array"); and

- means for distributing assignment of devices to parity groups throughout the

    balanced array such that all storage devices contain the same amount of data or

    parity information (col.7, line 66 to col.8, line 3).

Regarding claims 18 and 21, Stallmo further discloses means for dividing each storage

device into blocks; and means for organizing the blocks into stripes across the devices, wherein

each stripe contains data and parity blocks from each of the devices of the balanced array

(summary; col.8, lines 45-51).

Regarding claims 19 and 22, Stallmo further discloses the selecting patterns of characters

representing data storage devices of a stripe (summary and Figs.4-5).

Regarding claims 55 and 71, Stallmo discloses a computer implemented method for

enabling parity declustering of a storage system, the method comprising the steps of:

providing a first array of storage devices for storing data blocks and parity blocks, the

data blocks organized into at least one parity group associated with the parity blocks, the first

array storing an unequal number of blocks on differing ones of the storage devices (summary;

col.8, lines 45-51, and col.9, lines 46-53. Stallmo discloses the "first level" corresponding to "a

first array");

provi) a second array of storage devices for storing data blocks and parity blocks, the

data blocks organized into at least one parity group associated with the parity blocks, the second

array storing an unequal number of blocks on differing ones of the storage devices (summary;

col.8, lines 45-51, and col.9, lines 46-53. Stallmo discloses the "second level" corresponding to

"a second array");

combining the first and second arrays to form a combined array having substantially the

same number of blocks stored on each storage device of the combined array (summary; col.8,

lines 45-51, Stallmo discloses organizing a plurality of disks of varying sizes of data blocks "a

plurality of unbalanced stripe arrays" into multiple rectangles of disks that all contain the same

number of blocks "balanced array"); and

changing the association of data blocks with parity groups in the first array and the

second array so that each parity group is associated with data blocks that are distributed

substantially uniformly throughout the storage devices that store data blocks in the combined

array (col.6, lines 25-34; col.8, lines 45-51, and col.9, lines 46-53).

Regarding claim 56, Stallmo discloses organizing the data and parity blocks into stripes

across the storage devices (col.8, lines 45-51, and col.9, lines 46-53).

Regarding claim 57, Stallmo discloses wherein the step of redistributing comprises the

step of changing the association of the data storage devices with parity groups from stripe to

stripe in the combined array (col.6, lines 25-34; col.8, lines 45-51, and col.9, lines 46-53).

Regarding claim 58, Stallmo discloses wherein the step of changing comprises the step of

selecting differing patterns of characters representing data storage devices of a stripe (col.6, lines

25-34; col.8, lines 45-51, and col.9, lines 46-53).

Regarding claim 61, Stallmo discloses wherein the storage devices are disk drives (col.8,

lines 45-51, and col.9, lines 46-53)

Regarding claims 62 and 72-73, Stallmo discloses a computer-implemented method for

enabling parity declustering of a storage array having a plurality of storage devices, the method

comprising the steps of:

-       dividing each storage device into blocks (col.9, lines 14-20 and lines 46-53.

        Stallmo discloses a plurality of "squares" corresponding to "blocks").

-       organizing the blocks into a plurality of stripes across the storage devices,

        wherein each stripe contains data and parity blocks (col.9, lines 40-45 and

        col.11, lines 7-10).

-       storing data in data blocks and parity information in parity blocks, the parity

        blocks storing parity information for a plurality of parity groups (Fig.8; col. 11,

        lines 7-10 and lines 50-67); and

-       varying the association of the storage devices to parity groups from stripe to

        stripe in the storage array such that each parity group is associated with data

        blocks that are distributed substantially uniformly throughout the storage

        devices that store data blocks in the storage array (col.6, lines 25-34; col.9, lines

        40-45 and col.11, lines 7-10).

Regarding claim 63, Stallmo discloses wherein the step of changing comprises the step of

selecting differing patterns of characters representing data storage devices of a stripe to thereby

change the association of data blocks with parity groups from stripe to stripe of the storage array

(col.6, lines 25-34; col.9, lines 40-45 and col.11, lines 7-10).

Regarding claims 64 and 78-79, Stallmo discloses an apparatus for enabling parity

declustering of a storage system, the apparatus comprising:

-          a first array of storage devices for storing data blocks and parity blocks, the data

          blocks organized into at least one parity group associated with the parity blocks,

          the first array storing an unequal number of blocks on differing ones of the

          storage devices (summary; col.8, lines 45-51, and col.9, lines 46-53. Stallmo

          discloses the "first level" corresponding to "a first array");

-          a second array of storage devices for storing data blocks and parity blocks, the

          data blocks organized into at least one parity group associated with the parity

          blocks, the second array storing an unequal number of blocks on differing ones

          of the storage devices (summary; col.8, lines 45-51, and col.9, lines 46-53.

          Stallmo discloses the "second level" corresponding to "a second array");

-          a storage operating system configured to combine the first and second arrays to

          form a combined array having substantially the same number of blocks stored on

          each storage device of the combined array, and configured to change the

          association of data blocks with parity groups in the first array and the second

          array so that each parity group is associated with data blocks that are distributed

          substantially uniformly = throughout the storage devices that store data blocks in

the combined array (summary; col.8, lines 45-51, Stallmo discloses organizing a

plurality of disks of varying sizes of data blocks "a plurality of unbalanced stripe

arrays" into multiple rectangles of disks that all contain the same number of

blocks "balanced array").

Regarding claim 65, Stallmo discloses wherein each the blocks are organized into stripes

across the storage devices (col.8, lines 5-52; col.9, lines 14-20 and lines 46-53 and col.11, lines

7-10).

Regarding claim 66, Stallmo discloses wherein the storage devices are disk drives (col.8,

lines 5-52).

Regarding claim 67, Stallmo discloses wherein the storage devices are one of video tape,

optical, DVD, magnetic tape and bubble memory devices (summary and col.8, lines 35-44).

Regarding claim 68, Stallmo discloses wherein the system is a network-attached storage

appliance.

Regarding claim 69, Stallmo discloses an apparatus for enabling parity declustering of a

storage array having a plurality of storage devices, the system comprising:

-         a storage operating system configured to divide each storage device into blocks

         and organize the blocks into a plurality of stripes across the storage devices,

         wherein each stripe contains data and parity blocks and store data in data blocks

         and parity information in parity blocks, the parity blocks storing parity

         information for a plurality of parity groups (col.9, lines 14-20 and lines 46-53

         and col.11, lines 7-10. Stallmo discloses a plurality of "squares" corresponding

         to "blocks");

-       the storage operating system further configured to vary the association of the

storage devices to parity groups from stripe to stripe in the storage array such

that, each parity group is associated with data blocks that are distributed

substantially uniformly throughout the storage devices that store data blocks in

the storage array (col.6, lines 25-34; col.9, lines 40-45 and col.11, lines 7-10).

Regarding claim 70, Stallmo discloses wherein the storage operating system is configured

to select differing patterns of characters representing data storage devices of a stripe to thereby

change the association of data blocks with parity groups from stripe to stripe of the storage array

(col.6, lines 25-34; col.9, lines 40-45 and col.11, lines 7-10).

Regarding claim 74, Stallmo discloses wherein each unbalanced stripe array has fewer

parity blocks per disk than data blocks per disk (col.15, lines 51-62 and col.20, lines 15-29,

Stallmo).

Regarding claim 75, Stallmo discloses wherein each unbalanced stripe array has fewer

parity blocks per disk than data blocks per disk (col.14, lines 4-10; col.15, lines 51-62 and col.20,

lines 15-29, Stallmo).

Regarding claims 76 and 77, Stallmo discloses an apparatus for parity declustering in a

storage system, the apparatus comprising:

-       a storage operating system configured to combine a plurality of first arrays of

storage devices, each first array storing an unequal number of blocks per storage

device, to form a second array, the second array storing substantially the same

number of blocks on all storage devices (summary; col.8, lines 45-51, Stallmo

discloses organizing a plurality of disks of varying sizes of data blocks "a

plurality of unbalanced stripe arrays" into multiple rectangles of disks that all

contain the same number of blocks "balanced array");

- the storage operating system further configured to redistribute the assignment

storage devices to parity groups in the second array so that each storage device

will have a substantially equal number of blocks associated with each parity

group (col.7, line 66 to col.8, line 3).

6.   Claims 38, 40-41, 43-44 and 46 are rejected under 35 U.S.C. 102(b) as being anticipated

by Burton et al. (US Pub. 2003/0074527) of record.

Regarding claims 38 and 40, Burton discloses a method for declustering a parity array

having a plurality of storage devices, the method comprising the steps of:

- assigning a first plurality of data and parity blocks to a first parity group ([0017];

[0018]; [0019] and [0021]-[0025], Burton discloses a computer system include

an adaptor to manage the plurality of storage disk drives whereas the storage

device is assigned to span and organized into strips contains parity and data);

and

- assigning a second plurality of data and parity blocks to a second parity group,

the first and second parity groups being independent from each other and

distributed throughout the plurality of storage devices of the parity array

([0017]; [0018]; [0019]; [0021]; [0025] and Fig.2. Burton shows in Fig.2 that

the parity group in span1 is different from span2, span3. Therefore, they are

considered being independent from each other).

Regarding claims 41 and 43, Burton discloses a declustered parity array, comprising:

- a plurality of storage devices having a first and second parity group (abstract; [0017]; [0018]; [0019]; [0021]-[0025], Burton);

- a first plurality of data and parity blocks assigned to the first parity group; and a second plurality of data and parity blocks assigned to the second parity group, the first and second parity groups being independent from each other and distributed throughout the plurality of storage devices of the parity array ([0017]; [0018]; [0019]; [0021]; [0025] and Fig.2. Burton shows in Fig.2 that the parity group in span1 is different from span2, span3. Therefore, they are considered being independent from each other).

Regarding claims 44 and 46, Burton discloses a declustered parity array, comprising:

- a plurality of storage devices (abstract; [0017]; [0018]; [0019]; [0021]-[0025], Burton);

- means for assigning a first plurality of data and parity blocks to a first parity group ([0017]; [0018]; [0019] and [0021]-[0025], Burton discloses a computer system include an adaptor to manage the plurality of storage disk drives whereas the storage device is assigned to span and organized into strips contains parity and data); and

- means for assigning a second plurality of data and parity blocks to a second parity group, the first and second parity groups being independent from each other and distributed throughout the plurality of storage devices of the parity array ([0017]; [0018]; [0019]; [0021]-[0025] and Fig.2. Burton shows in Fig.2

that the parity group in span1 is different from span2, span3. Therefore, they are

considered being independent from each other).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7.   Claims 2 and 4-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stallmo

et al. (US 6,052,759) previous cited in view of Baylor et al. (US Patent no. 5,862,158).

Regarding claim 2, Stallmo discloses all of the claimed limitations as discussed above

except that all surviving data storage devices are loaded uniformly during reconstruction of the

failed storage device or devices. Baylor discloses a method for providing fault tolerance against

double device failures in multiple device systems including the steps of surviving data storage

devices and reconstructing storage device failures (col. 2, lines 28-55 and col.4, line 61 to col.5,

line 4, Baylor). It would have been obvious to one of ordinary skill in the art at the time of the

invention was made to modify Stallmo to include the claimed limitation as taught by Baylor. The

motivation of doing so would have been to enhance the storage device system's availability.

Regarding claim 4, Stallmo discloses all of the claimed limitations as discussed above

except the steps of dividing each storage device into blocks; and organizing the blocks into

stripes across the devices, wherein each stripe contain data and parity blocks from each of the

devices of the balanced array. Baylor discloses a method for providing fault tolerance against

double device failures in multiple device systems that storage device is divided into multiple data

blocks and organized the blocks into a set of data stripes (col.2, lines 28-55 and col.4, line 61 to col.5, line 4, Baylor). It would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify Stallmo to include the claimed limitation as taught by Baylor. The motivation of doing so would have been to enhance the storage device system's availability.

Regarding claim 5, Stallmo/Baylor combination further discloses the step of selecting patterns of characters representing data storage devices of a stripe to thereby change the association of the data storage devices with parity groups from stripe to stripe of the balanced array (see col.3, lines 28-45; col.4, lines 6-28, Baylor).

Regarding claim 6, Stallmo/Baylor combination further discloses that the characters are binary numbers (col. 5, lines 1-3, Baylor).

8.   Claims 7, 13 and 59-60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stallmo et al. (US 6,052,759) previous cited in view of Baylor et al. (US Patent no. 5,862,158) and further in view of Karr (US Patent no. 3,993,862).

Regarding claims 7 and 59-60, Stallmo and Baylor combination discloses all of the claimed limitation as discussed above, except "the characters are ternary numbers." Karr, however, discloses a system for compressing source data whereat the characters is ternary numbers (see col.4, lines 4-63, Karr). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Stallmo and Baylor including the claimed feature as taught by Karr. The motivation of doing so would have been to increase the system's performance, efficiency and it is cheap (col.5, lines 18-33, Stallmo).

Regarding claim 13, Stallmo/Baylor /Karr discloses the RAID layer is implemented in logic circuitry (see Fig.3-5 and corresponding text, Karr).

Conclusion

9.   The prior art made of record and not relied upon is considered pertinent to applicant's

disclosure.

      1. Akerib et al. (US 6,711,665 B1) disclose associative processor.

      2. Ulrich et al. (US Pub. 2002/0138559 A1) disclose dynamically distributed file system.

10.   Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Hanh B. Thai whose telephone number is 571-272-4029. The

examiner can normally be reached on 8 AM - 4:30 PM.

      If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Safet Metjahic can be reached on 571-272-4023. The fax phone number for the

organization where this application or proceeding is assigned is 571-273-8300.

      Information regarding the status of an application may be obtained from the Patent

Application Information Retrieval (PAIR) system. Status information for published applications

may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR

system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR

system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

                                                Hanh B Thai
                                              Examiner
                                              Art Unit 2163

January 23, 2006

                                         UYEN LE
                                   PRIMARY EXAMINER